LOUISIANA BOARD OF REGENTS
&
UNIVERSITY OF LOUISIANA SYSTEM

LOUISIANA TECHNOLOGY INNOVATION FUND PROPOSAL

LOUISIANA ENROLLMENT ADVANCEMENT DATAMART (*LEAD*):
A DATA WAREHOUSE PLATFORM FOR STATEWIDE ENROLLMENT ADVANCEMENT

I.	PROJECT TITLE

Louisiana Enrollment Advancement Datamart (*LEAD*): A Data Warehouse Platform for Statewide Enrollment Advancement

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III.	EXECUTIVE SUMMARY

The Louisiana Board of Regents and the University of Louisiana (UL) System, in partnership with two consultants, Noel-Levitz and the UL Lafayette Center for Business and Information Technologies, are submitting this request for a project to develop the "*Louisiana Enrollment Advancement Datamart (LEAD)*". The *LEAD* platform will serve as a planning and decision support data warehouse with associated analytical tools and enrollment management applications, empowering postsecondary education stakeholders - state administration, legislature, the Board of Regents, university systems, universities and colleges, to accomplish enrollment, retention and completion goals at each level.

The goals of the Board of Regents' Master Plan for Public Postsecondary Education: 2001 are: (1) Increase opportunities for student access and success; (2) Ensure quality and accountability; and (3) Enhance services to communities and state. Objectives to

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meet these goals include: increasing participation in public postsecondary education, increasing minority participation, increasing retention of first-time freshmen, and increasing the graduation rate.

In order to achieve these objectives, the Master Plan calls for the implementation of minimum admission criteria at all of the 4-year public postsecondary institutions beginning in fall 2005. In September of 2001, the Board of Regents contracted with the nationally recognized enrollment management consulting firm Noel-Levitz to conduct an Enrollment Management Assessment of all Louisiana public, postsecondary institutions. This assessment resulted in several recommendations on the necessary strategies and priorities that will lead to the successful implementation of the Master Plan. The Board of Regents has since contracted with Noel-Levitz to conduct activities to address some of their 67 recommendations, specifically in the areas of Planning and Marketing, Recruitment, Financial Aid and Retention. Louisiana's public colleges and universities have spent the better part of the last two years working with Noel-Levitz consultants to develop institutional specific marketing, recruitment and retention plans. As a result of this effort, campuses have been educated in the best practices of enrollment management and are working towards implementing their action strategies and meeting their individual campus goals.

One of the 67 Noel-Levitz recommendations called for the Board of Regents to "*Create a statewide data warehouse to support enrollment management…*". This data warehouse proposal is the next logical step in the on-going statewide enrollment management initiative and would support Louisiana institutions as they strive to meet their enrollment goals. Louisiana is the first state in the nation to undertake an enrollment management project of this magnitude at the state level, as envisioned in the proposed project, encompassing all levels of postsecondary education.

The *LEAD* initiative will *LEAD* the state of Louisiana to a postsecondary education system that is more accountable to the taxpayers and the people it serves, ensuring effective and efficient utilization of scarce resources. The project seeks $701,960 for this 2-year effort, expected to be piloted by Fall 2004 and fully operational by Fall 2005.

IV.	DESCRIPTION OF THE PROJECT

A. PROJECT NARRATIVE

Project Rationale

Like most institutions of higher learning, Louisiana universities have an abundance of student data but a paucity of information in a form easily accessible by users in academic administration. Student enrollment, retention and completion data are currently submitted to the Board of Regents by universities and colleges throughout the state. The data submitted resides in DB2 databases at the Board of Regents that do not have easy query-able front-end interfaces or analytical tools. Institutional managers and staff who desire access to information must understand database structures, have programming skills or

more often than not, seek IT assistance from BoR staff to meet their needs. This approach allows access to static snapshots of data, offering limited customizability, and analytical capabilities. The process induces delays and operational inefficiencies that make the mandate of measuring the state's postsecondary education progression a very cumbersome process.

As the state moves toward implementing admission criteria, developing an accurate assessment of how the new requirements will impact public postsecondary institutions in Louisiana will require a more comprehensive database than is maintained presently either at the institutional or statewide level. This requires the creation of a statewide data warehouse that integrates information regarding applicants to all Louisiana two- and four-year public colleges and universities, and information regarding their admission, retention and completion rates. This information could be used to audit implementation of the new admission criteria and evaluate yearly changes in enrollment, retention and completion, resulting from implementation of the new criteria.

Developing a statewide enrollment data warehouse that captures and centralizes the aforementioned data from Louisiana institutions to monitor key enrollment and performance parameters at the state level is a necessary first step in the right direction.

Over the past two years, Louisiana institutions have worked with Noel-Levitz consultants to develop a deeper understanding at institutional level about key benchmark variables that must be maintained to monitor and predict enrollment futures for postsecondary education in Louisiana. However, the problem remains that most institutions do not have the requisite tools to keep track of the parameters necessary to monitor the systemic impact of strategies on enrollment and postsecondary education goals. Studies have recommended that each postsecondary educational institution should maintain a database of its prospective high school students, starting as early as middle school. Basic funnel statistics for prospect-to-inquiry and inquiry-to-application should be maintained at the campus level, in addition to key retention indicators such as course completion data. The database would monitor the prospects' progression towards college, and serve as a tool for Louisiana postsecondary institutions to build awareness early in a student's high school career - for early prospecting and relationship building.

While Louisiana campuses are becoming aware of best-in-class practices in strategic enrollment management, most do not have tools that harvest existing data and support their enrollment management system (*EMS*) strategies and goals.

Accordingly, this project proposes to:
- Develop the statewide *Louisiana Enrollment Advancement Datamart* (*LEAD*) – a centralized data warehouse residing at the Board of Regents, which integrates key enrollment data from several Louisiana campuses and aggregates this information for statewide planning and enrollment assessment. The data warehouse will provide easy to use, interactive, query-able interfaces and analytical tools to allow stakeholders the ability to track progression towards their postsecondary education goals.

- Develop the *Enrollment Management System (EMS)* – a decentralized enrollment management application residing at institutional level, which integrates with campus information systems (prospect, retention, and completion) on one hand, and the *LEAD* Data Warehouse on the other. The *EMS* application will support the institutions' development of enrollment management best practices. The *EMS* will enable each Louisiana institution perform its own prospect tracking and student relationship management functions, locally and autonomously, while capturing performance data necessary at the Board level to consolidate institutional and statewide benchmarks.

In summary, with the implementation of the *LEAD-EMS* initiative, the state public postsecondary education system will be poised to pursue a systematic approach of target marketing to increase conversion and yield rates. The state-level *LEAD* data warehouse, integrated with institutional-level *EMS* database applications uses information technology in an innovative manner to develop an effective state-of-the-art enrollment management platform for Louisiana universities and colleges. The *LEAD* initiative offers Louisiana postsecondary education stakeholders such as the Board of Regents, university systems, universities and colleges, their administration, staff and faculty the ability to manage their collective and respective enrollment goals using innovative, web-based, interactive, data warehouse tools and applications, that leverage existing data, on-going efforts, and technology infrastructure.

Project Goals

The overarching goal of the project is to increase prospect recruitment, student admission, retention, and completion across Louisiana colleges and universities, while decreasing attrition and increasing customer satisfaction. The *LEAD* initiative will *lead* the state of Louisiana to a postsecondary education system that is more accountable to the people it serves, is customer-oriented, and is directed toward Louisiana's transformation to a knowledge economy. The *LEAD* project will provide institutional users and stakeholders across the state real-time access to integrated multi-dimensional information and tools that assist in defining goals and metrics, analyzing performance, adopting best-in-class enrollment practices, and interpreting institutional data to support strategic planning and policy-making processes.

Project goals include:
- *Real-time Datamart Access*: Providing stakeholders enhanced real-time, web-based interactive access to a multi-dimensional data warehouse of student enrollment, retention, and completion data required to serve the students, understand their needs and assess the effectiveness of the state in meeting those needs.
- *Enrollment Planning and Metrics*: Providing the ability to establish realistic statewide enrollment planning goals based on data provided by campuses throughout the state.
- *On-line Analytical Processing (OLAP) Tools:* Providing the ability to measure progress made toward accomplishment of enrollment goals by generating aggregate statistics and reports.
- *Enrollment Management System (EMS) Database Application:* Providing the ability, at institutional level, to implement proven enrollment management practices that

leverage institutional prospect databases and information systems to manage sustained relationships with students: prospect, current, matriculant, and alumnus.

- *Custom Reports:* Providing the ability to define customized reports, based on specific user privileges and needs, that allow effective measurement and monitoring of enrollment situation to support strategic planning and policy making.

Project Description

This project will design and develop a data warehouse architecture that leverages, consolidates and transforms existing data and information systems across campuses into useful enrollment management information that provides decision support, planning and analysis tools to all stakeholders, identified previously.

The *LEAD* data warehouse architecture will facilitate an effective interface to information by a broader population of campus users who are not familiar with where data is stored or how it is coded in operational systems. The *LEAD* data warehouse and its analytical tools will provide users at all levels, the ability to access data in real-time, customize reports to best fit their needs, conduct statistical analysis and evaluate what-if scenarios using OLAP (on-line analytical processing) tools, based on key data maintained and reported to the Board, by campuses statewide.

To facilitate campuses in maintaining and reporting key enrollment data, the *LEAD* project will develop an enrollment management system (*EMS*) application. The *EMS* application will provide participating campuses access to best management practices in enrollment management embodied into a software application; the ability to track key enrollment, retention, completion statistics at the institutional level; and the ability to automatically funnel these parameters into the *LEAD* warehouse for consolidation, performance tracking and report generation, statewide, by the Board of Regents. The *EMS* software will be offered to participating campuses as a locally-owned and controlled application to ensure security of sensitive prospect data. The application will be developed using open standards and interoperable technologies to enable integration with campus legacy information systems and the *LEAD* data warehouse.

Notes to the reviewer:
1. The *LEAD* data warehouse may be populated with consistent, validated, transformed, and summarized information gleaned automatically from campus *EMS* applications to be developed by this project or from raw data extracted manually from existing information systems such as Banner, People Soft, or other indigenous systems that are operational at Louisiana campuses. While participating with the *EMS* initiative is optional, institutions will be encouraged to investigate the applicability of the *EMS* paradigm to their campus enrollment and student relationship management functions.
2. The idea of offering the *EMS* application as a centrally hosted application was considered and discarded because campuses may be reluctant to populate their unit-level prospect data in the warehouse for considerations of security and competition.

Centralization of the data warehouse and decentralization of the feeder *EMS* application, as illustrated in **Figure 1** (page 13), allow all stakeholders (state administration, legislature, Board of Regents, systems, universities and colleges) with expanded access to information and sophisticated OLAP tools at their fingertips, all by just using the Internet browser on their workstations. Together, the overall *LEAD-EMS* system will enable colleges and universities to benefit from best-in-class student relationship management tools (similar to commercial customer relationship management) to establish life-long and sustained interactions with their students: from prospect, to applicant, to matriculant, to alumnus. The *LEAD-EMS* system will enable universities and colleges to be more service and customer oriented, increasing student satisfaction, leading to higher rates of retention and completion across the state.

A prototype will be developed and implemented within the University of Louisiana at Lafayette, to demonstrate the viability of *LEAD* data warehouse and the *EMS* architecture, in partnership with project consultants: Noel-Levitz and the Center for Business and Information Technologies, UL Lafayette. Once validated within a single university, the scope of the pilot will be expanded to include multiple campuses within the University of Louisiana System. These pilot implementations will demonstrate the flexibility and versatility of the proposed approach and the ability to interface with varied information systems and operating environments.

By the end of Year 2, the data warehouse will be ready for a statewide rollout to other Louisiana colleges, universities and systems. The *EMS* application will be available to these institutions, upon request, with integration services offered by 3rd party integrators.

Partnerships with private sector will be established to transfer and commercialize this technology beyond Louisiana. With the implementation of the *LEAD* initiative, Louisiana will be at the forefront of the states in the U.S. embracing innovative information technologies to practice state-of-the-art strategic enrollment management.

B. USE OF INNOVATIVE TECHNOLOGY

Doing more with less or with no increase in the amount of resources defines fiscal innovation that has its place in the current economic environment. True technology innovation is to accomplish more with existing resources by developing strategic tools that leverage existing infrastructures to encompass a greater scope and purpose. The *LEAD* initiative leverages such existing resources as databases, information repositories, hardware platforms and on-going process re-engineering efforts to provide a statewide enrollment management and planning tool.

The *LEAD* initiative will be the first effort of its kind in the U.S. to develop a statewide data warehouse to support the state's enrollment and postsecondary education goals, and offer enrollment services that can be accessed through a simple Internet browser.

A major technology innovation of the proposed project is a technical architecture that offers the benefits of centralized services, such as economies of scale, while allowing

local autonomy, customizability and control. The *LEAD* technical solution addresses these seemingly conflicting and mutually exclusive requirements in a synergistic manner.

Another innovative aspect of the project is the application of commercially proven customer relationship management (CRM) technologies to the domain of state postsecondary education that results in a more accountable, service-oriented, student-centric and responsive educational system. Louisiana colleges and universities will use the project's innovative student relationship management (SRM) tools to decrease their rates of attrition while simultaneously increasing their customer satisfaction metrics. An extension of this SRM domain innovation is in the delivery of the Enrollment Management System (*EMS*) software in the form of a decentralized application that integrates and leverages centralized data and services of the *LEAD* data warehouse. While the centralized data warehouse offers economies of scale, the decentralized *EMS* application, written in conformance with the J2EE architecture and object oriented technologies, offers application interoperability and cross-platform compatibility, that allows re-usability across multiple campus platforms.

Innovative data management technologies such as the eXtensible Markup Language (XML) will be utilized by this project to establish connectivity between the *EMS* application and different types of databases that may exist at different Louisiana campuses, in order to leverage past investments, legacy data and existing information systems. XML technology will be used to facilitate remote object communications that will enable *EMS* application residing at a campus to automatically request and receive information located at the remote data warehouse. This will be enabled using the web service architecture that implements the Simple Object Access Protocol (SOAP). Additionally, establishing connectivity interfaces between the *EMS* application and the *LEAD* data warehouse allows automatic funneling of campus data: information on applicants, enrollees, retention and graduation rates, etc., into *LEAD* data warehouse in a standardized manner. Likewise, institutions using *EMS* may benefit from being able to extract unit records of prospects from the Educational Planning and Assessment System (EPAS) and high-school student transcript data, to populate their own prospect databases.

Together, the *LEAD-EMS* platform will result in an integrated environment for strategic enrollment management, statewide. The technology innovation of the project will result in the development of the *LEAD-EMS* architecture that is scalable, extensible, and interoperable, capable of meeting varying enrollment management models and goals at each campus, while offering high-levels of qualities of service such as autonomy, local data control, customizability, security, availability, and maintainability. This new untested technology extends the capabilities of end-users: Louisiana universities and colleges, their administration, staff and faculty.

In addition to the technology innovation, the project also represents an organizational innovation, by being the first of its kind to establish and leverage partnerships between state entities (Board of Regents, University of Louisiana System), University (UL Lafayette) and the private sector (Noel-Levitz) in developing, piloting and transferring

this technology. By partnering with Systems and University developers, this project will overcome traditional barriers to technology adoption within campuses.

C. MULTI-AGENCY APPLICATION OR PORTABILITY TO OTHER AGENCIES

This project's main objective is to provide an improved toolset – a data warehouse with associated tools and software applications for inter- and intra-institution management and monitoring of statewide enrollment related goals, measures and reports. The project serves a broad base of stakeholders in the postsecondary education system, including, state administration, legislature, Board of Regents, systems, 4-year universities, 2-year colleges, technical colleges and high schools.

Funding for this project will result in the development of the centralized *LEAD* data warehouse at the Board of Regents for the benefit of the Board, systems, universities and colleges across Louisiana. The centralized warehouse will integrate data received from several campuses and assist in generating aggregated reports and statistics that monitor the progress being made in accomplishing individual and aggregated goals of the state's colleges and the state as a whole.

In addition to benefiting from the data warehouse, participating colleges and universities would also benefit from the Enrollment Management System (*EMS*) to be developed as part of this project. The *EMS* software will be made available to colleges and universities throughout the state of Louisiana as locally hosted application that interfaces with their campus systems and the centralized *LEAD* data warehouse, in assistance with the project consultants. The *EMS* will enable academic institutions throughout the state to aggressively pursue their individual enrollment related goals.

The "TOPS Reporting System" may be plugged into the data warehouse as a module to support scholarship in Louisiana. In addition, the proposed *LEAD* initiative could benefit the departments of administration and education to provide answerability and accountability to the state legislature and the general public.

D. BENCHMARKING PARTNERS AND/OR BEST PRACTICE REFERENCES

The Best Practice References of this project are derived from the Noel-Levitz consultant report, based on a thorough review of the current situation across Louisiana campuses.

Best Reference Practices: The Noel-Levitz report recommends that the Board of Regents should "…*compile a statewide enrollment planning database to aid enrollment managers in setting realistic goals and identifying threats and opportunities*" as a best reference practice to improve the performance of the state postsecondary educational system. The proposed project implements this recommendation by developing a centralized data warehouse that offers integrated access to multi-dimensional information with associated tools and services, statewide.

Benchmark Implementations: **Baylor University**, a private school affiliated with the Baptist General Convention of Texas, has a student population of 14,000. Baylor is blazing the strategic enrollment management trail by employing data warehousing, data mining and reporting capabilities using SAS strategic enrollment management tools.

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Similarly, **Rensselaer Polytechnic Institute** has undertaken a data warehousing effort to meet the University President's vision of centralized information systems and improved decision support throughout the institute.

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Most reported implementations are at university, institute or at best at system-level (North Carolina State College System, Minnesota States Colleges and Universities System, Kentucky Community and Technical College System, etc.) This project will be the first of its kind in the U.S. to develop a statewide enrollment data warehouse, spanning across multiple campuses and university systems.

E. LONG-RANGE PLANNING

This proposal is being submitted primarily by the Board of Regents whose mission is to support postsecondary education in Louisiana. The proposed project seeks to develop an enrollment data warehouse and associated tools/applications that are directly in support of this mandate. As such, the Board of Regents staff will use the proposed new technology, well beyond a 5-year period. The Board of Regents has in place the consultant and in-house expertise, staff, infrastructure and the commitment to support this project. Other stakeholders and users of the proposed technology include high schools, colleges, technical colleges, universities, and university systems that will also be required, by mission and mandate, to continually manage, monitor and improve their enrollment performance. It is thus fully expected that these users will continue to use the proposed technology beyond the life of this project.

Additionally, this project is one of the key initiatives included in the State IT Master Plan. It is consistent with the consolidation and centralization recommendations of the Noel-Levitz consultant team. In addition, the proposed project leverages previous investments made by the state into recruiting the consulting services of Noel-Levitz to conduct an analysis of state colleges and universities vis-à-vis their enrollment

management practices. The *LEAD* project is the cornerstone of recommendations provided by Noel-Levitz, which include: "*to compile a statewide enrollment planning database to aid enrollment managers in setting realistic goals and identifying threats and opportunities in the external environment…*" More specifically, the project implements their Recommendation #4 "*…to create a statewide data warehouse to support enrollment management and the more accurate assessment of the impact on enrollment of the new admissions criteria as proposed in the Master Plan.*"

This project is structured to ensure that the vision for a vibrant postsecondary education system is achieved by establishing an infrastructure that accommodates best management practices, new applications, and information technology advancements as normal "business" practice. More importantly, the *LEAD* portal, coupled with its OLAP tools and *EMS* applications, should bring Louisiana into the top ten states in systemic reform and educational accountability.

The long-term plans for this project include licensing the technology to other states in partnership with Noel-Levitz and other Louisiana IT companies. In transferring this technology across and beyond Louisiana, the project will have met the mandate of technology transfer of *Louisiana Vision 2020: Master Plan for Economic Development.*

F.   PERFORMANCE GOALS

The success of this project will be measured by the percentage of Louisiana universities and college campuses that use *LEAD* warehouse and the *EMS* tools to pursue their enrollment management goals. The key to the success of the *LEAD* project is the extent to which it provides information and services that meet users needs in a consistent, uniform format. The success of the portal for the three years following implementation will be measured based on the following indicators:

No.	Indicator Name	Indicator value
1.	Percentage of campuses who use the *LEAD* data warehouse to monitor, track and report progress to the Board of Regents	FY 2005/06: 60% FY 2006-07: 70% FY 2007-08: 80%
2.	Percentage of campuses who use the *EMS* application to manage their student relationships: prospect, applicant, matriculant & alumnus	FY 2005/06: 30% FY 2006-07: 40% FY 2007-08: 50%

Other metrics that will be tracked include: number of users supported, number & types of reports generated, and volume of data stored in the data warehouse, among others.

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G.   TECHNICAL APPROACH

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1.   Technical Description

Technical Requirements

The *LEAD-EMS* system technical architecture is schematically represented in **Figure 1** (page 13). The hybrid architecture represents an integrative framework that interfaces the centralized *LEAD* data warehouse with instances of decentralized *EMS* applications operational at different campuses.

Infrastructure Layer: The *LEAD* data warehouse infrastructure layer leverages and integrates existing hardware, software and networking components already in place at the Board of regents and campuses across the state. Existing hardware (IBM iSeries "Midrange" running OS/400 V5R2M0), network (LaNet and other open networks), software components (IBM DB2 OLAP Server version 8.1, IBM DB2/400), web server (IBM HTTP server) and Apache application server clusters will be integrated. The infrastructure also comprises various databases and information system resources such as the BoR Statewide Student Profile System, BoR Completers System, BoR Inventory of Degree and Certificate Programs, among others.

Middleware Services Layer: The *LEAD* platform implements a range of middleware services such as content management, customization and security to enable the design and deployment of lightweight, scalable and extensible enterprise applications that can access system resources in a flexible manner. These middleware services include:

- *Content Management Services*: The *LEAD* content management service facilitates integration of data across different platforms that requires identifying and mapping of various sources of data, defining standards of interoperability and synchronization, and ensuring that data can be staged across multiple dimensions of the data warehouse in a consistent and automatic manner. The capability to provide content and manage it effectively is key to obtaining maximum value from the warehouse. The use of descriptive XML schema and metadata to implement the content management service will allow non-technical (information) content publishers and subscribers to use the warehouse effectively.
- *Security Services*: Any type of decision-support environment that deals with institutional, prospect, student, alumni and donor data must be secure. The *LEAD* security services will protect the privacy and integrity of student records, especially from other institutions that will also be utilizing the shared *LEAD* data warehousing infrastructure and centralized applications. Security must exist at the data, application and transaction levels. Another important aspect of security is to ensure that only those who have been authenticated and who are authorized have access to specific types of data, information and analyses.
- *Customizability Services*: No two institutions are the same; hence no two environments would be quite alike. While there will be common features, institutions using the *LEAD* customization services will to be able to customize their environment, the reports and the data to best fit their organizational needs.

Application Layer: The *LEAD* warehouse application layer provides search engines, OLAP tools and customizable report generation tools. The application layer components utilize the services offered by the middleware layer, described above.

- *Search Engines*: The *LEAD* warehouse search engines will allow retrieval of information across structured, semi-structured, and unstructured documents (including word-processing documents, spreadsheets and databases) that may be stored on the data warehouse. The proposed search engines will handle increasing volumes of content and allow for unlimited growth of users and queries with no degradation in performance or accuracy. It also features search operators, modifiers, natural language queries, Boolean searches and fuzzy search capabilities.

- *OLAP Tools: LEAD* OLAP tools will leverage key institutional enrollment aggregated data such as prospect, applicant, graduate, and rates of completion, retention, etc., extracted from, and/or provided by campuses statewide to the Board of Regents. The DB2 data warehouse will aggregate and integrate such multi-dimensional data, while the *LEAD* OLAP tools (programmable IBM DB2 OLAP server components) enable on-line analytics and multidimensional analysis that aggregate and retrieve information from multiple data sources, statistical analysis and combine "what-if" hypothesis driven questions with discovery driven analysis.

- *Report Generator:* The report generator tools utilize the customization and content management middleware services to allow users customize the content and the style of their reports. The report generator offers a very high degree of customizability, by allowing users to select from within and across multiple dimensions of warehoused data and data elements from each of these dimensions. Authorized users will be able to create and save report templates into a public template library so that they do not need to create them from scratch.

The *infrastructure–middleware-application* layer stack comprises the technical architecture of the *LEAD* data warehouse. This design and implementation of this architecture will allow server-client interfaces where the client could be a simple web browser or a sophisticated application such as the *EMS* running at an institution.

The *EMS* provides each institution with student relationship management tools that keep track of prospect, prospect-to-applicant, applicant-to-graduate data that are automatically funneled to the centralized *LEAD* data warehouse. The *EMS* application will be developed consistent with the J2EE architecture and object oriented technologies, offering application interoperability and cross-platform compatibility that allows re-usability across multiple campus platforms.

Additionally, the *EMS* application will utilize XML data standards to establish connectivity with different types of databases that may exist at different Louisiana campuses, in order to leverage past investments, legacy data and existing information systems. XML technology will be used to implement web services that will serve as programmatic interfaces between the *EMS* application and the *LEAD* data warehouse.

EMS Users

Campus 1 Campus 2

Non-EMS Users

Campus 3 Campus 4 Campus 5

Internet Web Services Internet FTP

Search Engine OLAP Tools Report Generator

APPLICATION LAYER

Content Management Security Customization

MIDDLEWARE SERVICES LAYER

Web Servers Various Databases Application Server
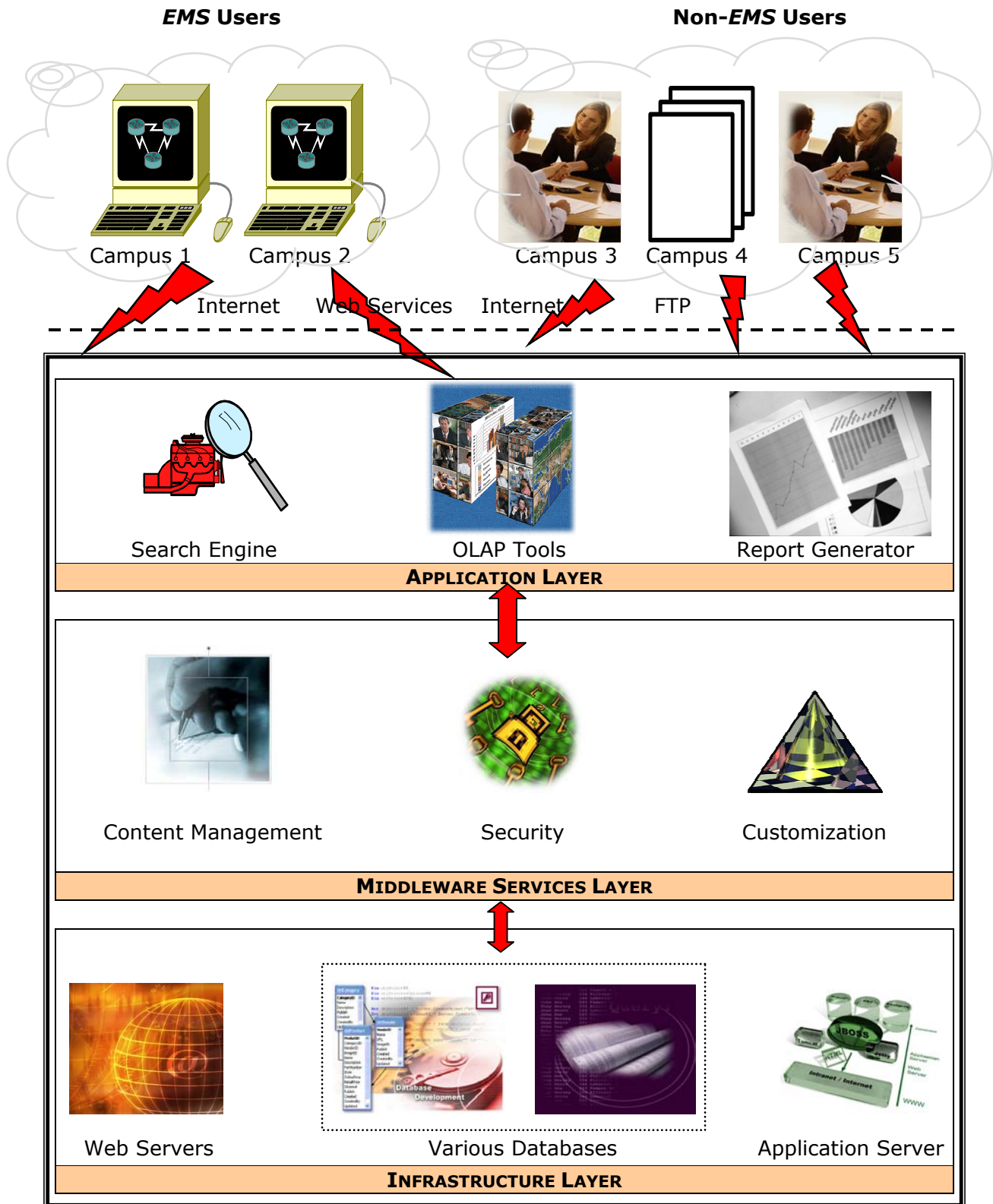
INFRASTRUCTURE LAYER

Figure 1. The *LEAD-EMS* Technical Architecture

The EMS application interfaces will allow Louisiana institutions to employ best-in-class enrollment management practices, while programmatically managing, tracking and reporting institutional enrollment data to the LEAD data warehouse. While the adoption of EMS application will be highly recommended and encouraged, Louisiana institutions will still be able to use their existing legacy information systems such as Banner, People Soft, etc. or their homegrown applications for enrollment management. Such users may extract and manually report the data to the LEAD data warehouse, by uploading their data in flat files using FTP.

Benefits & Features
- **Interactive:** Making decisions and building relationships is a highly interactive process. The *LEAD-EMS* architecture will enable people to interact with data and other decision makers.
- **Simple user interface:** *LEAD-EMS* system users will be able to explore what-if scenarios or to move data by simply dragging and dropping it with a point-and-click interface. Users will also be able to choose output formats (e.g., HTML, e-mail), report styles and customize their graphical interfaces. Data trends can often be spotted quickly from an image rather than from pages of numbers. A graphical scorecard gives presidents and vice presidents who are pressed for time a quick synthesis of the institution's progress toward its strategic goals.
- **Integrated:** End-to-end capability of *LEAD-EMS* is important. Although processes such as enrollment management are comprised of multiple steps, it is most efficient to integrate those processes so the information flows continuously from end to end. The time required to integrate and synchronize independent services can be enormous. And the opportunities for errors and delays increase with every hand off.

2. Interoperability

The *LEAD* data warehouse and the *EMS* application will be designed, consistent with the J2EE architecture, component technologies and XML data standards to be interoperable and usable system-wide and statewide, primarily through web-enabled software. A key feature of the design is its extensibility to a variety of other access channels leveraging emerging technologies in web services and the wireless domain. Interoperability will be included as a key requirement in consultant contracts issued for the project. In addition, the open-standards based *LEAD-EMS* architecture permits replacing components as better technologies emerge and provides the capability to migrate to other hosting and operational platforms.

3. Scalability

Louisiana institutions range widely in terms of number of students and faculty, types of information systems used, etc. College and university systems can also face data and decision-making challenges that span multiple institutions. The *LEAD* technical architecture is based on open, scalable and extensible components that can grow in scale and scope, as *LEAD-EMS* based recruitment, and student relation management programs

grow in popularity. In addition, the *LEAD-EMS* technical architecture is scalable to accommodate an increased number of colleges and universities, number of users and stakeholders, and also in terms of the range and scope of services offered by the system.

4. Maintainability

The Board of Regents will host and maintain the *LEAD* data warehouse, while individual campuses will need to maintain their respective *EMS* applications. The expertise and infrastructure needed to maintain and manage the data warehouse are available within the Board of Regents. The proposed project includes training resources to fully transition this operational support to state staff by the end of the project timeframe. Professional services of CBIT will initially provide maintenance support and upgrades for the warehouse and its application tools and services. The project also includes training resources to allow transition of *EMS* application maintenance to respective institutions by the end of the project period.

H. IMPLEMENTATION APPROACH

This project focuses on measurable results that build upon iterative successes. This contrasts with the "big bang" approach, which often entails launching a large-scale implementation in the absence of a "proof-of-concept" or pilot project. Our approach integrates the optimal combination of technology, information sharing, and technical or subject-matter expertise to implement a tailored solution that meets an institution's needs.

The *LEAD* project will be based on a repeatable approach focused on the implementation of a pilot at UL Lafayette, followed by a rollout across the University of Louisiana System, to test and prove the concept. As these pilot projects are implemented, issues arise based on unpredictable elements requiring flexibility and change. Discovering these issues during the pilot stage helps improve the overall implementation by improving the concept and reducing overall cost. The project will be implemented as follows:

Task 1. Data Model and Application Design
   a. *User Requirements:* Business users and their requirements impact almost every decision made throughout the implementation of the *LEAD-EMS* platform. "*User Requirements*" subtask includes all the activities necessary to get a full understanding of the enrollment management business domain.
   - Selecting interviewees and conducting interviews.
   - Conducting data audits and analyzing results.
   - Publishing requirements deliverables.
   b. *Logical Modeling:* Logical design is the next step following business requirements and data audits. The results of this modeling effort will be a set of alternatives that will be presented to the Committee for review.
   - *LEAD* Data Warehouse: A detailed analysis of data sources and transformation rules will be conducted. This includes:
      - Dimension modeling - Translating business requirements into star schema designs and evaluating and designing aggregate tables;

- Analyzing data sources - Identifying data sources and transformation rules.

Specifications for the three components of the *LEAD* Application Layer will be developed, including a *Search Engine* for structured and unstructured data retrieval by end users, an *OLAP toolset*, and a *Report Generator* capable of producing detailed and aggregated reports at institutional, system and BoR levels.

- *EMS* Application: Inputs, outputs, processes and best practices for efficient and effective management of recruitment, enrollment and outcome tracking of prospective students developed in the requirements phase will be used to build a process model for an enrollment management system.

c. *Physical design:* The physical design will be based on the logical model, approved by the *LEAD* Steering Committee.
- *LEAD* Data Warehouse Design: Task will include defining standards, estimating data base size, developing index plan, developing partitioning plan, and designing physical tables and columns.
- *EMS* Application Design: Forms, reports, and processes defined in the logical design will be translated into design specifications of the *EMS*.

Task 2. Model and Design Validation
a. *LEAD Data Warehouse Model Validation*: Once the data modeling effort is complete, the project team will consult with Noel-Levitz to ensure that the data model incorporates their findings and recommendations for developing a comprehensive enrollment management warehouse and data funneling applications. The Noel-Levitz consultant team will:
- Review unit record data and validate collection business rules for creation of a system-wide data warehouse with the metrics and processes congruent with practices developed by Noel Levitz for the Board of Regents.
- Review/Evaluate Data Mart(s): Dimensions; Dimension Table; Fact Table; Grain; Hierarchy; Levels; Measures.
- Review/Evaluate OLAP cubes structured around Data Marts; Review/Evaluate virtual OLAP cubes.
b. *EMS Application Specification:* Once the data warehouse model validation is complete, the project team will again consult with Noel-Levitz and the *LEAD* Project Steering Committee to ensure that the application incorporates their requirements and recommendations for a comprehensive enrollment management system.

Task 3. System Implementation
a. *LEAD Data Warehouse:*
- Implementation: This task will include such activities as optimizing DBMS parameters, building physical storage structure, completing table and index sizing, and creating tables and indexes.
- Data Staging: This stage is the core of building the data warehouse. During this task, the processes that load data from both *EMS* and non-*EMS* systems will be as follows:

- Design and development – Designing high level staging process; developing detailed staging plan by table; defining and implementing staging metadata; developing initial load; developing incremental loads; designing and implementing data cleansing and aggregation processes; developing data quality assurance process.
- Populate and validate database – Setting up production environment; loading initial data; loading historical data; performing data validation and quality assurance processes.
- Performance tuning – Setting up benchmark queries; reviewing indexes and aggregations; performing tools tuning; monitoring database.

   b. *EMS Application:*
- Implementation: This task will include the development of the *EMS* application, based on the validated system design, using the J2EE reference architecture, object oriented technologies and XML data standards.
- Interface with the *LEAD* Data Warehouse: This task will develop application program interfaces (APIs) between the *EMS* application and the *LEAD* data warehouse on one hand, and campus legacy applications on the other, to integrate prospect-applicant-graduate-alumnus information into one powerful platform. Integration among these diverse systems will be accomplished using the emerging Web Service Architecture its Simple Object Access Protocol (SOAP).

Task 4.   System Validation

In partnership with the *LEAD* Project Steering Committee, the Noel-Levitz consultant team will validate the *LEAD-EMS* system, to make sure the tools and the services developed by the project meet their recommendations and the state's needs. Noel-Levitz will develop benchmarks and validate that the *LEAD* data warehouse, OLAP functions and *EMS* applications deliver the information necessary for enrollment management planning and decision making to achieve master plan objectives prior to launching a pilot project.

Task 5.   Pilot Implementation

Pilot implementation will proceed in the following two stages:
   a. *Phase I – UL Lafayette*: During this phase the *LEAD* Data Warehouse will be implemented for UL Lafayette on a test basis. Once the data warehouse is tested, the *EMS* system will be launched and tested by UL Lafayette Enrollment Management personnel. The phase will also test the linkage between the *EMS* application and the *LEAD* Data Warehouse. Problems and issues encountered will be reviewed and recommendations for improvement will be made. The *LEAD* Data Warehouse and *EMS* will be modified, as required, before proceeding to Phase II.

   b. *Phase II – University of Louisiana System:* Scalability and extensibility of the *LEAD* Data Warehouse will be tested through implementation within select University of Louisiana System colleges and universities. The scope of the *LEAD*

Data warehouse will be expanded to include additional UL System campuses. As part of this phase, the *EMS* application will be deployed across additional ULS campuses, to prove the applicability of the warehouse as well as the *EMS* application across multiple operating environments. After individual component testing and validation, validation against existing reporting systems will be performed as an acceptance test for the system.

Task 6. User Training
The project team will partner with CBIT, the system development consultant in conducting a series of training workshops to campuses throughout the state. Existing H.323 teleconferencing capabilities across Louisiana campuses will be leveraged, minimizing travel costs and overhead.

Task 7. Statewide Deployment
Based upon successful pilot implementations within UL Lafayette and the UL System, the project will be ready for statewide deployment. The scope of the *LEAD* data warehouse will be now expanded to serve all stakeholders: state administration, legislature, Board of Regents, university systems, universities and colleges, high schools, etc. At this stage of the project, the *EMS* application will be available to other Louisiana campuses, upon request.

Task 8. System Maintenance
- Provide on-going user education and training
- Provide on-going user support
- Maintain technical infrastructure; Maintain end user quality of service
- Monitor on-going success, identify and perform changes and enhancements

Task 9. Project Administration
Includes all activities necessary to get the project off the ground, establish teams, manage the design and development process, monitor progress, generate reports, and facilitate successful pilot and deployment.

The project schedule is as follows:

LEAD-EMS Project Schedule																								
	Calender months after project begins																							
	Year I												Year II											
Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Data Model & Application Design																								
2. Model and Design Validation																								
3. System Implementation						LEAD			EMS															
4. System Validation								LEAD			EMS													
5. Pilot Implementation																								
At UL Lafayette									LEAD			EMS												
At ULS											LEAD			EMS										
6. User Training																								
7. Statewide Deployment																								
8. System Maintenance																								
9. Project Administration																								

I. ASSESSMENT OF RISKS

As with any implementation project, there are risks associated with implementing a *LEAD* Data Warehouse. Early identification and planning can substantially reduce any adverse impact on the project.

- **Most of the people will be new to the project** - Consideration should be given to the initial group dynamics.
- **Current analytical culture** – Creating a *LEAD* Data Warehouse is all about providing improved access to better information to support decision-making. This can cause a cultural change as to how we place value on information and analysis.
- **New technology and skills set learning curve** - The implementation of the data warehouse is very different from purchasing and implementing ERP systems. At its core, it relies on new Web-based technology and a new set of tools – at both institutional level (*EMS*) and state-level (*LEAD*). Providing the necessary training, as tasked by this project, can reduce this risk.
- **Continued campus cooperation and support** – The success of the *LEAD* Data Warehouse and the adoption of the *EMS* application at campus-level relies heavily on the interest and commitment of institutional users to specify their needs, evaluate the models and test the tools. A systemic effort should be made to support these tasks.

J. INTEGRATION WITH EXISTING TECHNOLOGIES

The project will leverage existing hardware and software components that exist at the Board of Regents. This will allow the system to be utilized by state departments and can be easily adapted to any future changes of statewide IT standards. The *LEAD* system architecture is designed to utilize the exiting infrastructure and standards for networking, application servers, database servers, web servers, operating systems, and database software at BoR.

More specifically, these include:
- Hardware:
  - IBM iSeries "Midrange" running OS/400 V5R2M0.
- Software:
  - IBM DB2 OLAP Server version 8.1 (includes OLAP Analyzer 8.1)
  - IBM DB2/400, Sequel Report writer/Tabler
- Database(s):
  - BoR Statewide Student Profile System
  - BoR Completers System
  - BoR Inventory of Degree and Certificate Programs.
- Web Server IBM HTTP Server
- Apache 2.0.43 w/ASF Tomcat
- WAN - T1 (equiv.)

K. PROJECT BUDGET AND COSTS

1. EQUIPMENT

Direct Access Storage Device (DASD) upgrade: The capacity of the existing DASD device will need to be upgraded, in order to best utilize existing BoR infrastructure for this project. This upgrade will cost $12,000.

Memory upgrade: A $2,000 memory upgrade on the server is necessary to provide reasonable quality of service to user requests.

Cost Summary:

Item	Quantity	Unit Price	Total
DASD Upgrade	1	$12,000	$12,000
Memory Upgrade	1	$ 2,000	$ 2,000
Total			**$14,000**

2. SOFTWARE

OLAP Server Licenses: The project will buy 5 more seats of OLAP server to help in the software development stage of the *LEAD* warehouse implementation. The development and run-time licenses for the database, application server and the web server are already in place.

Cost Summary:

Item	Quantity	Unit Price	Total
DASD Upgrade	5	$1,000	$5,000
Total			**$5,000**

3. TELECOMMUNICATIONS

No cost to the project. Supported by the existing architecture of the Board of Regents.

4. PROFESSIONAL SERVICES

The project will contract with two consulting groups, one to design, develop and implement the system, and the other to validate the design and system implementation. The number in parentheses indicates consultant offering the professional service. UL Lafayette's Center for Business and Information Technologies (CBIT) will serve as Consultant #1, while Noel-Levitz will serve as Consultant #2 for the proposed project. Cumulatively, they will perform the following:

Data Model and Application Design (1): Professional services of CBIT will be required to design the *LEAD* data warehouse and the *EMS* applications. It is expected that 800 hours at $85/hr will be required for this task.

Model and Design Validation (2): The project wishes to leverage previous investments by the state into a Noel-Levitz study, by entering into a professional services contract to make sure the data model and *EMS* application design meets their recommendations. Noel-Levitz will review unit record data and validate collection business rules for creation of a system-wide data warehouse with the

metrics and processes congruent with practices developed by Noel Levitz for the Board of Regents. Further they will review/evaluate the Datamart, OLAP cubes, and the *EMS* application design. It is expected that 360 hours at $214/hr of Noel-Levitz consultant time will be required for this task.

System Implementation (1): CBIT's professional services will be required to implement the *LEAD* data warehouse, the Enrollment Management System, and interfaces between the two. It is expected that 3200 hours of consultant time at $70/hr will be required for this task.

System Validation (2): The project will validate the system implementation before the pilot, through a review by the *LEAD* Project Steering Committee and also by entering into a professional services contract with Noel-Levitz to make sure the tools and the services developed by the project meets their recommendations and the state's needs. Noel-Levitz will develop benchmarks and validate that the *LEAD* data Warehouse, its OLAP functions and the *EMS* applications deliver the information necessary for enrollment management planning and decision making to achieve master plan objectives prior to launching a pilot project. It is expected that 360 hours at $197/hr of Noel-Levitz consultant time will be required for this task.

Pilot Implementation (1): The project team will partner with CBIT, the system development consultant, to pilot the *LEAD* data warehouse and the *EMS* applications, first at UL Lafayette, followed by select campuses within the UL System. It is expected that 1200 hours of consultant time at $70/hr will be required for assistance in training campus users, BoR staff and other stakeholders.

User Training (1): The project team will partner with the system development consultant in conducting a series of training workshops to campuses throughout the state. Existing H.323 teleconferencing capabilities across Louisiana campuses will be leveraged, minimizing travel costs and overhead. It is expected that 600 hours of consultant time at $75/hr will be required for assistance in training campus users, BoR staff and other stakeholders.

Statewide deployment (1): Based upon successful pilot implementations within UL Lafayette and the UL System, the project will be ready for statewide deployment. The scope of the **LEAD data warehouse** will be now expanded to serve all stakeholders. It is expected that 800 hours of CBIT consultant time at $70/hr will be required.

System Maintenance (1): While most of the data warehouse infrastructure will be maintained by the project PIs and the team at the Board of Regents, CBIT professional services will be required for assistance in maintaining the warehouse and provide necessary upgrades, during the pilot and deployment stages. It is expected that 400 hours of consultant time at $70/hr will be required.

Project Administration (1): Professional services will be required to assist in administration and implementation of the proposed *LEAD* initiative. It is expected that 500 hours of consultant time at $60/hr will be required for this task.

Cost Summary for Consultant 1

Item	Quantity	Unit Price	Total
Data Model Design	800	$ 85/hr	$ 68,000
System Implementation	3,200	$ 70/hr	$224,000
Pilot Implementation	1,200	$ 70/hr	$ 84,000
User Training	600	$ 75/hr	$ 45,000
Statewide Deployment	800	$ 70/hr	$ 56,000

System Maintenance	400	$ 70/hr	$ 28,000
Project Administration	500	$ 60/hr	$ 30,000
Sub-Total (1)			**$535,000**

Cost Summary for Consultant 2

Item	Quantity	Unit Price	Total
Data Model Validation	360	$214/hr	$ 77,040
System Validation	360	$197/hr	$ 70,920
Sub-Total (2)			**$147,960**

Cost Summary for Professional Services

Item	Total
Professional Services – 1	$535,000
Professional Services – 2	$147,960
Total	**$682,960**

5. OTHER COSTS

None

V. FUNDING REQUESTED

Funding Category	Total Cost	Other Sources	Funding Requested
Equipment	$ 14,000	$0	$ 14,000
Software	$ 5,000	0	5,000
Telecommunications	0	0	0
Professional Services-1	$535,000	0	$535,000
Professional Services-2	$147,960	0	$147,960
Other	0	0	0
Total			**$701,960**

VI. COST/BENEFIT ANALYSIS

To recruitment: Institutions using this new approach and the accompanying solutions may recruit more students. If the institution increases enrollment by 1 percent, the value may be significant. For example, if an institution has 15,000 students paying tuition of $5,000 per year, a 1 percent increase in enrollment results in $750,000 of increased revenue. In addition, targeting students most likely to enroll can save significant variable expenses.

To retention: Effective retention and enrollment management plans (already in place on campuses) will require good aggregate measures and metrics for campuses to effectively manage enrollment as well as prepare for the new admission criteria prescribed in the

Master Plan. Increases in retention rates will certainly help "offset" revenue decreases associated with reductions in first-time freshmen enrollment. Revenue stabilization is and will continue to be a very important "issue" associated with the implementation of the Master Plan (admission criteria). First Year Revenue (self-generated tuition and fees only) impacts could be as high as 21.4 million dollars statewide (first-year). However, a one percent increase in the retention rate could translate into 650 thousand dollars (first-year) and as much as 3.25 million dollars throughout the cohort's educational career.

To advancement: Customer-relationship and enrollment management strategies benefit alumni programs as well. In an institution with a pool of 75,000 alumni who donate $100 each year, a 1 percent increase in annual giving would result in increased revenue of $75,000. The increase could be even greater if the personalized attention and communications encourage more generous alumni contributions.